

**Commissioner of Industries
Hyderabad
Andhra Pradesh**

Polyurethane Products

1. Nature Of The Product And Its Applications :

Polyurethanes play pivotal roles in homes, office and industry. Residential and commercial buildings are insulated by polyurethane foam, refrigerators, water heaters, exterior doors, picnic coolers, etc. too. PUs are widely used in automobile interiors toys, shoes, undersea cables and space shuttles.

2. Market :

Today, the largest markets are transportation, construction and furniture. Together, these 3 areas consume 60% of the estimated 22 billion rupees of polyurethane products in the world.

Polyurethanes are generally classified by the types, of materials produced (rigid or flexible foams) or by end use applications (coatings, adhesives, etc). Here we are concerned with the former one. Rigid foam market constitute of 25% of the total of all the varieties as said earlier put together.

Annual growth through the end of decade is likely to average 5%.

3. Description :

These consist of urethane linkages formed by the reaction of isocyanates with molecules containing hydroxyl groups or other groups with active hydrogens. The bulk of polyurethanes used worldwide are based on two aromatic isocyanates Toluene Di Isocyanate (TDI) and Methylene Di Isocyanate (MDI). These materials are occasionally derived under controlled conditions to form carbodimide isocyanates or reacted with low molecular weight glycols to form speciality pre-polymers. Such derivatives can simplify material handling, ease processing and improve foam properties.

4. Technology/Manufacturing Process :

Compounds with active hydrogens, which make up the other half of the reaction system, typically consist of polyoxypropylene glycols (polyether polyols), sometimes supplemented with small quantities of low molecular weight glycols such as ethylene glycol or butanediol. In specific micromolecular foam applications (Reaction injection mouldings), a diamine (Diethyl, toluenediamine, etc) may be used in place of glycols. In some cases, polyester polyols based on adipic acid and ethylene glycol or butanediol may be used instead of polyether polyols.

The unique character of polyurethanes is at least partly due to the ability of the polymer to undergo phase separation into hard segments (MDI & Glycols) and soft segments. This phase separation imparts hardness and toughness to polyurethanes, yet allows it to retain excellent resilience and flexibility.

Depending upon the active hydrogen compound present, urethane reaction can be slow or fast. Amine and metal catalysts are used to drive the reaction to completion as rapidly as possible and allow for fast demold of part. These can be molded in densities ranging from 2 to 70 lb/cft. For foams below 60 lb/cft, a blowing agent must be added, usually to polyol. Surfactants, pigments, catalysts, flame retardants and UV stabilisers are few other additives.

Most urethanes are made using dispensing machines that combine the isocyanate and polyol streams at present mixing ratios and outputs and deliver the mixture under controlled rates into

various moulds. Curing times for parts of moulds, range from 30 sec. to several mts. depending on formulations and geometry, urethane materials may be supplied as raw materials or as 'systems' containing preblended isocyanates as one component and (polyol + additives + catalysts + surfactants + pigments) as other.

TDI and polyether polyols give forms of 1 to 2 lb/cft. After flexible foams, rigid foams constitute the largest application sector, construction, tank and pipe insulation. Transportation and marine industries use rigid foams.

These are based on polymeric MDI, which in many cases, is partially converted into an isocyanurate which imparts to foam, a higher temp. resistance than that of most others. Low molecular weight high functionality polyols provide other reaction ingredient.

5. Capacity :

1 TPD capacity is viable level of production and hence is considered here.

6. Raw Materials

Requires importation from countries like Germany and Netherlands. Polyol, toluene diisocyanate and additives are major requirements.

7. Plant And Machinery

Major equipments required are:

Reaction injection moulding (RIM) equipment reactants mixing tanks. Mould blocks, Cutters, etc

8. Utilities

Power : 200 HP
Water : 6000 KL per day

9. Plant Location

Any chemicals processing zone in any industrial area, far away from city due to inherent (toxic and flammable nature of reactants) and products is preferred.

10. Land & Buildings

In a land of 10,000 sq mt area, about 4,000 sq mt has to be dedicated for buildings for this project. The total cost may be Rs.5 lakhs.

11. Other Features

Safety at every stage is required.

12. Machinery Supplier

M/s Hennecke, Germany

13. Raw Material Supplier

M/s BASF or M/s Bayer. etc.

14. Project Cost And Means Of Finance

Project. Cost.

Particulars	Rs. Lakhs
Land	5.00
Buildings	12.00
Civil works	2.00
Plant and machinery	360.00
Other fixed assets	15.00
POP Expenses	10.35
Deposits	0.50
Margin Money Working Capital	12.91
Contingencies on Bldg	0.60
Contingencies on P&M	36.00
Total	454.36

Means of Finance

Term Loan	292.24
Margin Money	162.12
Total	454.36

15. Raw Materials Requirement

Particulars	Rs. Lakhs
Polyols - 138 tonnes @ Rs-80,000	110.40
Additives - 15 tonnes @ Rs.10.000	1.50
Toluene Di-isocya - 147 tonnes @ Rs.64000	94.08
Total	205.98

16. Salaries and Wages

Particulars	Nos.	Salary/month/person
Manager	1	Rs. 5,000
Sales Staff	1	Rs. 2,500
Office Assistants	2	Rs. 2,000
Security	1	Rs. 1,000
Plant Supervisor	1	Rs. 4,000

Skilled Workers	6	Rs. 2,000
Unskilled workers	3	Rs. 1,500

17. Break-even Point

Particulars	Rs. Lakhs
Variable Expenses	
Raw materials	164.78
Consumables	2.16
Utilities	9.38
Packaging material	4.28
Repairs, Maintenance, Insurance	12.31
Interest on working capital	8.40
Wages	2.97
Total variable expenses	204.28
Contribution	202.01
Fixed Semivariable Expenses	
Depreciation	19.79
Admn. salaries	1.81
Admn. expenses	25.89
Interest	34.52
POP Expenses	1.04
Total fixed/semivariable expenses	83.05

Sales realisation : 406.30
 BEP at 80% capacity utilisation : 41.11%
 BEP at installed capacity : 32.89%